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A note on the optimum profile of a sprayless planing surface

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Abstract

The paper presents an exact analytical solution to the problem of finding the optimum profile of a two-dimensional plate which planes on a water surface without spray formation and maximizes the lift force. The lift is maximized under the only isoperimetric constraint of fixed total arclength of the plate. The exact solution is compared with approximate analytical and numerical results by Wu & Whitney (1972). The shape of the optimum plate turns out to be technically unrealizable because of small, tightly wound spirals near the end points. It was shown numerically that cutting off small segments near the end points leads on the one hand to insignificant change in the lift force and on the other hand to a non-separating boundary layer along the remaining part of the optimum plate.